Dryden Flight Research Center
Edwards, California 93523-0273

DHB-S-002
Baseline

DRYDEN HANDBOOK

CODE S

QUALITY ASSURANCE SPECIALIST PROGRAM/PROJECT SAFETY AND MISSION SUCCESS GUIDELINES

Electronically Approved By:
Chief, Office of Safety and Mission Assurance

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PURPOSE AND SCOPE

The purpose of this document is to maximize the effectiveness of the Quality Assurance support for programs/projects as it is practiced at the Dryden Flight Research Center.

This document explains the guidelines and expectations associated with the Quality Assurance Specialist who supports programs/projects in achieving safety and mission success per NPG 7120.5A requirements

Guidelines

The program/project manager should establish a safety and mission success activity as a part of the risk management process. To implement the effort, the program/project manager, with the assistance of any safety and mission assurance organization, or other relevant organization, should develop a subelement of the program/project plan to address the process for achieving safety and mission success. The plan should detail such activities as system safety, reliability engineering, electronic and mechanical parts reliability, quality assurance for both hardware and software, surveillance of the development processes, “closed loop” problem failure reporting and resolution and environmental design and test requirements. The plan should be developed early in the program formulation process. Mission success criteria should be defined to aid in early assessment of the impact of risk management trade-off decisions. The safety and mission success activity should accomplish the following:

a. Provide for formal assessment and documentation of each hazard, with risks identified, analyzed, planned, tracked, and controlled.

b. Provide for a safety assessment and certification regarding readiness for flight or operations, explicitly noting any exceptions arising from safety issues and concerns.

c. Utilize a quality management system governed by the ISO 9000 standard, and appropriate surveillance.

Quality Assurance Program/Project Tasks/Guidelines

General:

The quality of any system is the result of an effective integration of the quality requirements into the design, manufacturing, and testing of the end product. Without an implemented quality plan, there will be no assurance that the product will function as required or will operate safely. It is therefore imperative that each program/project should ensure that quality-engineering expertise is applied throughout all project phases, from concept through operations, to implement the requirements specified during the Safety and Mission Assurance (SMA) requirement selection process. These quality requirements should be met throughout all project phases, including preliminary and engineering design, development, fabrication, processing, maintenance, field use, flight or operations preparation, flight operations, and post-flight/operations analysis.

Reliability/Maintainability:

The reliability of any system is the product of an intelligent design in which reliability principles are thoroughly coordinated with other design attributes. System effectiveness, of which reliability is a principal element, can only be achieved if the system performs its mission for the required time period without failure. Similarly, the necessity to enable cost-effective repairs, modifications, and upgrades to any system demands consideration of maintainability as a design characteristic on all projects. The key element of the maintainability effort is the identification of those design attributes, which allow rapid identification of malfunctions and fault locations, plus minimum effort in implementing physical repairs to the system. It is therefore imperative that each program/project should ensure that reliability and maintainability expertise is applied throughout all project phases, from concept through operation.

Quality Assurance:

The project quality assurance representative (QAR) and the project manager should implement the actions necessary to provide adequate confidence that the product will conform to the established requirements. The assigned QAR should review the project specifications and recommend to the project manager appropriate quality requirements to be incorporated into the SMA provisions of the project SMA plan. The review should consider mandatory inspection points, process surveillance, source inspection, test

witnessing, test requirements, and other appropriate quality-related actions deemed necessary to ensure that the resulting product meets the project goals. Key elements of a quality program plan include:

a. Identification of the principal QAR and clearly defined responsibilities, organizational interactions, and authority of this individual.

b. Discussion of each quality assurance (QA) requirement defined by the SMA requirement selection process, including who is responsible, completion schedules, and reporting requirements.

c. Major QA schedules milestones to be achieved.

d. Identification of formal QA reports or documents to be prepared.

Parts/Materials:

The project manager and the project QAR should establish and implement controls to ensure conformance to the specification and quality provisions of all purchased articles and services. Evaluation and selection of procurement sources should be considered, the project QAR should prepare the necessary criteria for project approval. These should include consideration of:

a. A demonstrated continuing and effective QA system.

b. The supplier’s “track record” on previous Government contracts.

c. Previous experience in producing the same or a similar product or service.

d. Management stability.

e. Overall industry reputation.

f. At the request of the project, funded by the project, conduct contractor site visit/audit.

The need for state-of-the-art components in advanced system development may sometimes preclude the use of standard high-reliability parts and materials required by the project criticality. Under these circumstances, the project manager should initiate the preparation, under the auspices of reliability engineering, of procurement specifications for the selected nonstandard parts and materials, which contain appropriate environmental and operating stress screening tests.

The project QAR should participate in the review of these procurement specifications to ensure that appropriate reliability screening requirements, comparable to those applied to standard parts considered as a baseline for the project, are adequately defined. The QAR should survey the screening test supplier to ensure that adequate test equipment and test expertise are in place to permit satisfactory test accomplishment.

Processes Control:

Process control refers to the entire process of producing a product and the method by which you control and ensure that your processes are followed. These should include consideration of:

a. A controlled work environment that ensures that the quality of the product is adequate and in conformance with specifications.

b. Adequate and controlled written instructions (procedures) or representative samples that ensure proper assembly and workmanship standards. These standards should define the criteria for acceptable workmanship.

c. The process should define the equipment, environment, reference standards, and quality plans, and must include regular monitoring during production. The equipment used by the employees must have appropriate operating instructions and maintenance plans.

d. Authorized personnel must review work instructions. These instructions are required whenever their absence could adversely affect the quality of the output. The instructions should be reviewed periodically to ensure adequacy and proper alignment with other procedures. The work instructions must clearly define the acceptance criteria so the operator can differentiate the good from the bad.

e. A “special process” is any process that cannot be fully confirmed through immediate testing or inspection so a defect may only surface when the product is being used. Typical examples are welding, painting, and heat treatment of materials. These processes require identification as special processes, clearly defined process parameters, operation by appropriately trained personnel using qualified equipment, and/or continuous monitoring with supporting records.

f. Review and approve system functional tests, servicing procedures, pre-flight and post flight checks.

g. Review system procedures generated by an outside agency/contractor and approved by the appropriate agency/contractor authority.

Contamination Allowance and Control:

The project manager, with support from the project QAR, should consider the need for cleanliness requirements during the fabrication, assembly, testing, operation, and storage of project equipment. When necessary, the project SMA plan should describe the controls and procedures to be implemented and criteria for maintaining and measuring conformance. Areas of environmental control to be considered include the work environment, work surfaces, tool, fixtures, handling, storage, shipping, containers, and test and inspection equipment. The project QAR should verify the initial cleanliness controls prior to any work on affected project materials, and should conduct periodic reviews to ensure continued conformance to established criteria.

Performance Verification:

The project manager, in conjunction with the project QAR, should schedule surveys of personnel, procedures, services, and operations, which implement the program. Each such action should be performed by a team of personnel familiar with all written procedures and standards applicable to the operations, work areas, software, or documentation of the system being surveyed and should include personnel not having specific line responsibilities in those areas. Each survey should include examination of all operations and documentation, evaluation of actual operations as compared with established requirements, recommendations for remedial and preventive action, and follow-up to assess results of the recommendations. The results and recommendations of the surveys in each area should be documented in a report to the project manager. The project QAR should be directly involved with the follow-up reviews to ensure that required corrective action has been implemented.

Software Assurance:

The magnitude and criticality of the computer software required by many current systems mandate a rigorous and comprehensive software test and checkout effort to ensure early detection and correction of software design and coding errors. The verification and validation (V & V) process will provide management visibility, as well as expedite assessment of proposed changes and their consequences. In this context, verification is defined as the process of determining whether the outputs of a given software development phase fulfill the requirements established during the previous phase; validation is the process of evaluating software at the end of the development cycle to ensure compliance with all software requirements. The planning and execution

of these tasks should constitute a continuing effort throughout the software development cycle.

The project QAR should assist the project manager in the planning, implementation, and evaluation of the V & V activities by:

a. Assisting, as required, in preparation of the V & V plans.

b. Monitoring the V & V activities as a QA function.

c. Supporting the preparation of discrepancy reports.

d. Assisting in development of corrective actions.

e. Serving as a member of the software CCB.

f. Supporting the follow-up and closeout of discrepancy reports and the verification or validation of corrective actions.

Design Review:

The project QAR should participate in major design reviews, and all technical reviews in which QA issues may arise. During these reviews, the QAR should ensure that the designs presented have considered appropriate hardware quality attributes, that software development incorporates sound software quality principles and procedures, and that related quality considerations are well defined. QA design criteria should be developed for both hardware and software and utilized in the design, and should serve as a checklist during the design reviews to ensure compliance with the criteria. Participation in review activities should be documented. The QAR should accept quality-related action items, monitor the progress of open action items, and assist in the resolution of these items. When appropriate, the QAR should actively participate in the design reviews by preparing and presenting quality status and problem briefings.

Configuration Management:

The project manager should establish a configuration management function, which will define a baseline configuration for hardware and software and to identify and control all changes to the baseline. A configuration management (CM) plan should be prepared to describe the procedures for accomplishing these functions. The project QAR should monitor and support the CM activities to ensure that a complete baseline configuration exists at the appropriate project milestone, and that changes to this baseline are formally and completely documented in accordance with the configuration control

procedures established by the Center CM plan. The project QAR or the designated alternate should serve as a member of the Configuration Control Board (CCB) for both hardware and software changes and should monitor the follow-up and closeout of all change requests.

Relevant Documents:

The following documents list is provided for reference only, check the master list at http://xnet.dfrc.nasa.gov/iso9000/, verify the correct version before use.

DCP-A-007 Rev A. Credit Card Purchases by Non-Contracting and Contracting Office Personnel

DCP-O-002 Rev B. Work Order Process

DCP-O-003 Baseline. Mission Control Process

DCP-O-006 Rev B. Process Specification

DCP-O-007 Rev B. Control of Inspection, Measuring, And Test Equipment (IM&TE)

DCP-O-009 Rev A. Operational Readiness Review (ORR) And Operational Review Board (ORB)

DCP-O-011 Baseline. System Procedures Preparation and Release

DCP-P-002 Rev A. Flight Research Project Formulation

DCP-P-003 Rev B. Project Plan

DCP-P-009 Rev B. Research Project Flight Authorization

DCP-P-016 Rev A. Configuration Management Of Flight Research Projects

DCP-P-017 Rev A. Configuration Change Process For Flight Project Critical Systems

DCP-P-018 Rev A. Discrepancy Report Process For Flight Project Critical Systems

DCP-S-001 Baseline. Aircraft Mishap Response Procedure

DCP-S-002 Rev A. Hazard Management

DCP-S-003 Baseline. Quality Assurance Review For Purchase Requests

DCP-S-004 Rev A. System Safety Support

DCP-S-006 Baseline. Contractor Quality Audit

DCP-S-007 Baseline. Software Assurance

DCP-X-008 Baseline. Tech Brief (T/B) And Mini-Tech Brief (Mini-T/B)

DCP-X-009 Baseline. Airworthiness and Flight Safety Review Board (AFSRB)

DHB-P-002 Baseline. Project Manager’s Handbook

DHB-S-001 Baseline. System Safety Handbook

DHB-X-001 Baseline. Airworthiness and Flight Safety Review and FRR (Old BOM app. 31)

DMSM Rev A. Dryden Management System Manual

DOP-F-710 Rev A. Flight Loads Laboratory Project Support

DOP-F-730 Rev B. Structural Dynamics Ground Vibration Test Support

DOP-F-740 Rev C. Remotely Augmented Vehicle (RAV) Flight Support

DOP-O-001 Rev A. Aircraft Engineering Design

DOP-O-002 Rev A. Flight Activity Scheduling (O)

DOP-O-003 Baseline. Receipt and Storage of NASA Explosives

DOP-O-004 Rev A. In-House Engine Maintenance

DOP-O-005 Rev A. Flight Line Engine Maintenance

DOP-O-006 Baseline. Fact Sheet Preparation & Update

DOP-O-007 Baseline. Cockpit Safety Review

DOP-O-010 Baseline Life Support Systems Standard Operating Procedure

DOP-O-011 Rev A. Aircraft Maintenance Control

DOP-O-012 Rev A. Mission Management Aircraft

DOP-O-017 Baseline. Life Support Technician Qualification and Certification

DOP-O-018 Baseline. Certification Training

DOP-O-019 Baseline. Aircraft Maintenance Standard Operating Procedure

DOP-O-022 Rev A. Operations Engineering Drawing Control

DOP-O-023 Baseline. Aircraft Weight and Balance (W&B)

DOP-O-121 Rev A. Material Control

DOP-O-122 Rev A. Manufacturing With Hazardous Material

DOP-O-402 Rev A. Redline Changes To Drawings/Work Orders

DOP-O-403 Baseline. Shop Work Flow for Work Orders, Parts Control Tags and Service Requests

DOP-O-404 Baseline. Communication/Navigation (COMM/NAV) Fabrication

DOP-O-405 Baseline. Flight Operations Calibration Laboratory Inspection, Measuring and Test Equipment (IM&TE) Support

DOP-O-500 Baseline. Review and Closure of Work Orders

DOP-O-501 Rev B. Quality Inspector (QI)/Designated Inspector (DI) Training

DOP-O-502 Rev B. Product Quality Deficiency Report

DOP-O-503 Rev A. Non-Destructive Evaluation (NDE)

DOP-O-506 Rev A. Quality Witnessing and In-Process and Final Inspection of Hardware

DOP-R-003 Rev B. FTS Configuration Control Process

DOP-R-004 Rev B. FTS Receiving, Issuing and Certification

DOP-S-001 Rev A. Government Industry Data Exchange Program Process (GIDEP)